

Report for 2005GU62B: Development of a Source, Transmission and Storage model of the Saipan Water System.

Publications

- There are no reported publications resulting from this project.

Report Follows

PROJECT SYNOPSIS REPORT

Project Title: Development of a Source, Transmission and Storage Model of the Saipan Water System

Problem and Research Objectives

In Saipan, Commonwealth of the Northern Marianas Islands (CNMI), large investments have been made in water distribution system improvements, but delivery problems still exist. The major problem is that many areas of the island that are being served by the public water system do not have 24-hour water service. A stated goal of the CNMI government is to provide 24-hour water to all residents served by the Commonwealth Utility Corporation (CUC) water system. This goal will be unattainable until the CUC has a complete knowledge of their water delivery capabilities and operational limitations.

Over the years the CUC water distribution system has grown and new wells have been added to the system. This physical expansion has been well documented but improvements in the hydraulic characteristics and delivery capabilities of the entire system have never been fully examined.

The Saipan water distribution system has been divided into 10 operational sub-regions. Each region is expected to operate somewhat independently. However, due to inadequate inflow to the system, system leakage, and lack of knowledge of the system behavior as a whole, the system is unable to provide complete 24-hour water service. In the past WERI researchers have developed computerized models of each of the ten sub-regions of the CUC water system using the Haestad WaterCad water system modeling program. The models included a physical system description, details of water usage, and parameters describing system operation. This previous project involved the examination of the entire system behavior when each of the sub-systems was operated independently.

The goal of this latest project was to develop a skelatonized model of the entire water delivery system. Skelatonization means to remove all but the major water sources, tanks and transmission components of each sub-region and then joining these sub-regions together at the regional boundary points. The benefits expected from the project include a better understanding of: the adequacy of the existing pumps and well systems, the adequacy of the existing storage facilities to provide for daily fluctuating demands, the ability of the well and storage system to provide sufficient flows, and a more in depth comprehension of the most efficient means to move water from water supply rich regions to those that have supply shortages in order to maintain delivery of 24 hour water to all areas in the system.

Methodology

The steps that were taken to complete the goals of this project were to: develop a skeletonization of each water sub-region which reflects the transmission and major distribution lines, join all the sub-region, and operate the model for water system management. As mentioned earlier, the project investigators previously developed separate models of each of the 10 sub-regions. These models included a complete

description of the physical components of the pipes, tanks, pumps, and the wells in the system.

The first step of this project was to remove pipes except the main transmission lines from the existing 10-region water system models. This process is called system skeletonization. Then we joined the regions together at the boundary points. During this stage we were working closely with CUC Engineering Staff, to gather any missing data on the physical and hydraulic description of all major transmission lines transmitting water from the well and spring sources to the storage facilities. We also updated the new model to include any new data on the physical and hydraulic description of all the major transmission lines available to transmit water to the population centers.

Principal Findings and Significance

The most important outcome of this project was the development of a complete water distribution model that describes the physical components of the Saipan water delivery system. The model has been verified through field visitation. As the result of this project, Saipan is the only island in the western Pacific that has a complete working model of their entire water system. Figure 1 shows one of the pumping stations in region 7. The skeleton model that has been developed will enable the CUC to explore various operational schemes for moving water from pumps such as shown in Figure 1 to system storage sites. This will help the agency provide water to the customers for a longer time period than a few hours a day. Figures 2 and 3 provide an illustration of the skeletonization process as applied to Region 7 of the water distribution system. Figure 2 shows all the existing pipes within the Region 7 and Figure 3 shows the skeletonized system of the same system. The skeleton systems for each of the water systems sub-regions have been inputted into Haestad Water Distribution System model. The CUC has purchased the Haestad model. Researchers working on this project provided detailed training in the use and operation of the model and engineers in the Water Division of CUC are presently operating the model.



Figure 1. Saipan's pumping station, Kagman area.

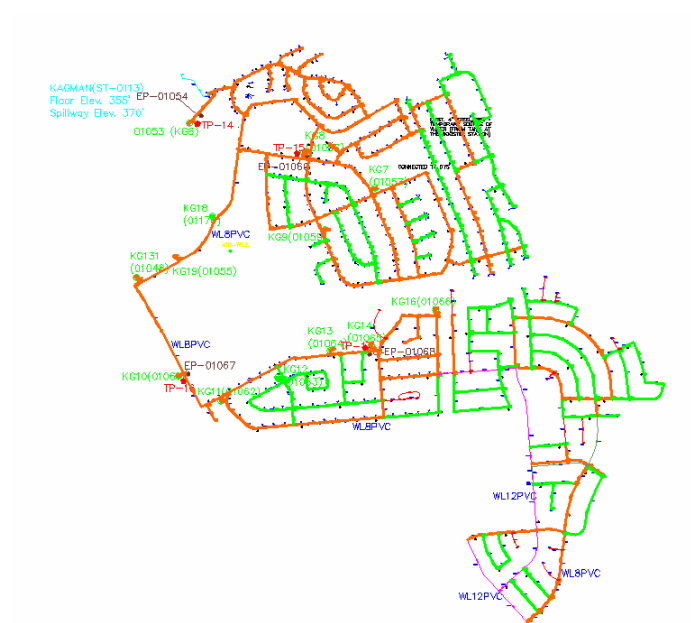


Figure 2. Region 7, Kagman, all pipes.

